



U.S. DEPARTMENT OF
ENERGY

Nuclear Energy

Integral Benchmark Evaluations (MS-NE-1)

Rob Versluis

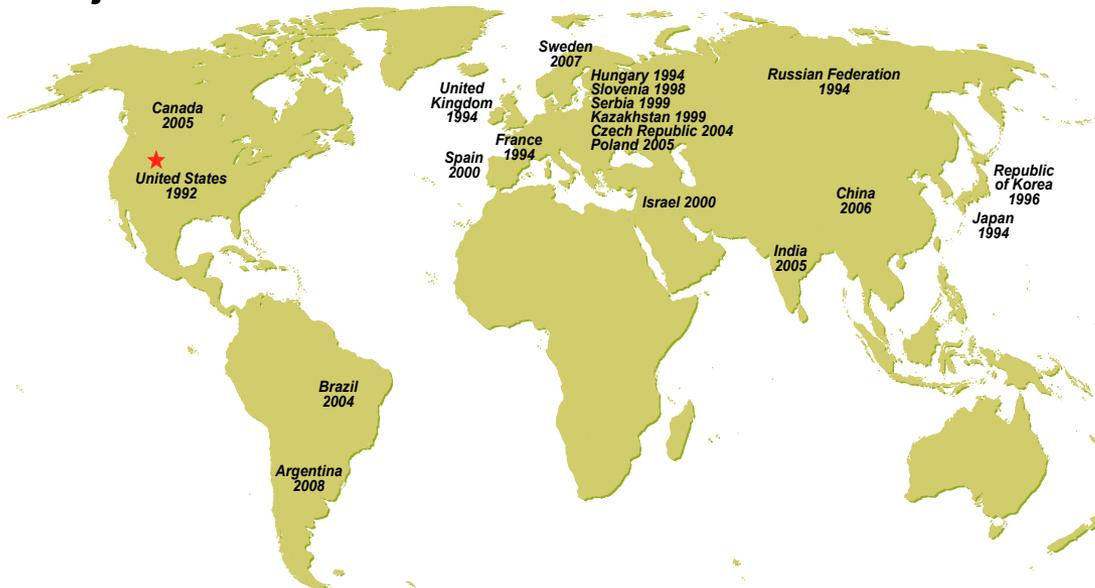
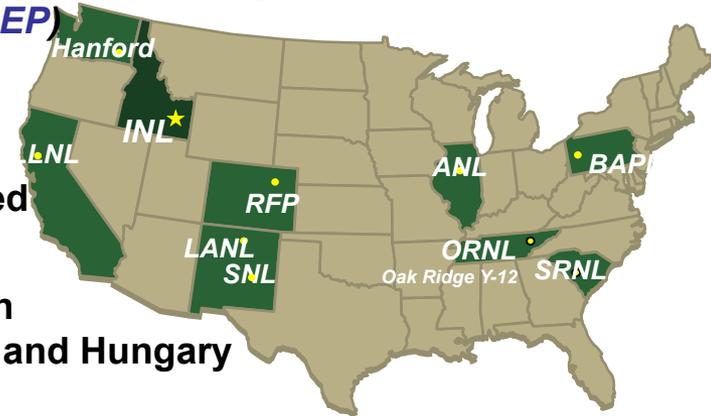
Office of Science and Technology Innovation

**Office of Nuclear Energy
U.S. Department of Energy**



History of International Criticality Safety Benchmark Evaluation Project (ICSBEP)

- Initiated in October of 1992 by the Department of Energy’s Defense Programs – Called the *Criticality Safety Benchmark Evaluation Project (CSBEP)*
- Managed through the Idaho National Laboratory (INL)
- Initially nationally known criticality safety experts involved
- The CSBEP became an international activity in 1994 when the United Kingdom, France, Japan, Russian Federation, and Hungary joined the effort.



- Renamed the International *Criticality Safety Benchmark Evaluation Project (ICSBEP)* in 1995 when mandated through the Organization for Economic Cooperation and Development (OECD) Nuclear Energy Agency’s (NEA) Nuclear Science Committee (NSC).



History of International Reactor Physics Experiment Evaluation Project (IRPhEP)

- Initiated as a pilot activity in 1999 by the OECD NEA Nuclear Science Committee – INL involvement from the beginning

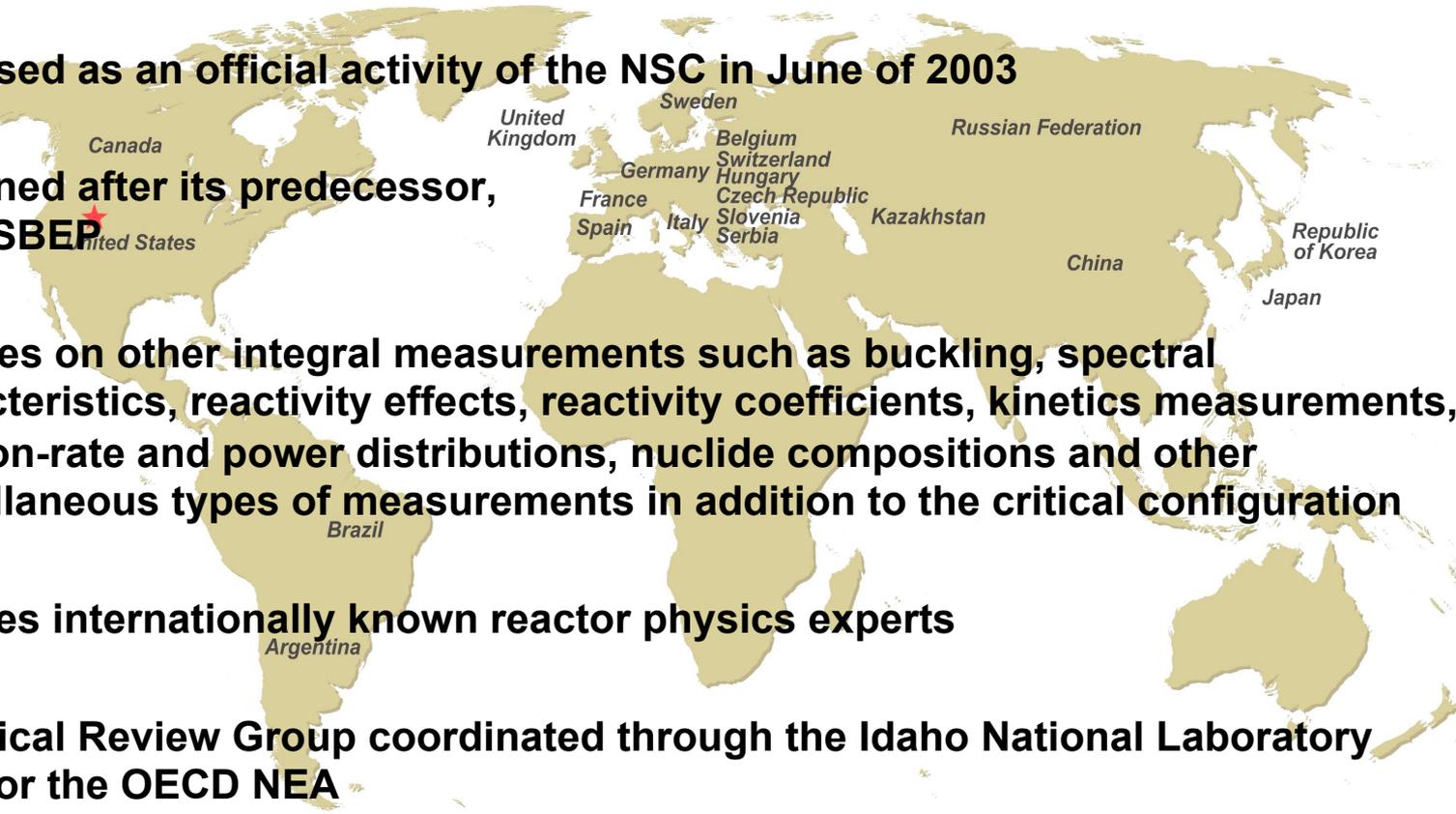
- Endorsed as an official activity of the NSC in June of 2003

- Patterned after its predecessor, the ICSBEP

- Focuses on other integral measurements such as buckling, spectral characteristics, reactivity effects, reactivity coefficients, kinetics measurements, reaction-rate and power distributions, nuclide compositions and other miscellaneous types of measurements in addition to the critical configuration

- Involves internationally known reactor physics experts

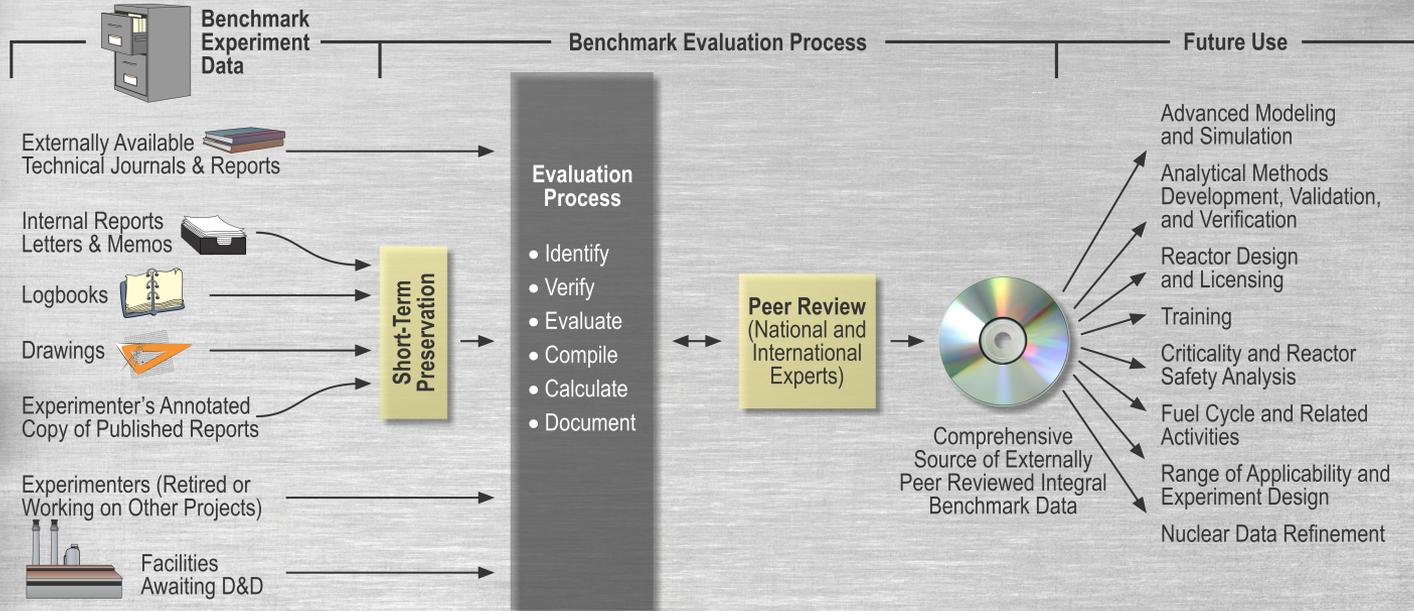
- Technical Review Group coordinated through the Idaho National Laboratory (INL) for the OECD NEA





Purpose of the ICSBEP and IRPhEP

INTERNATIONAL BENCHMARK PROGRAMS

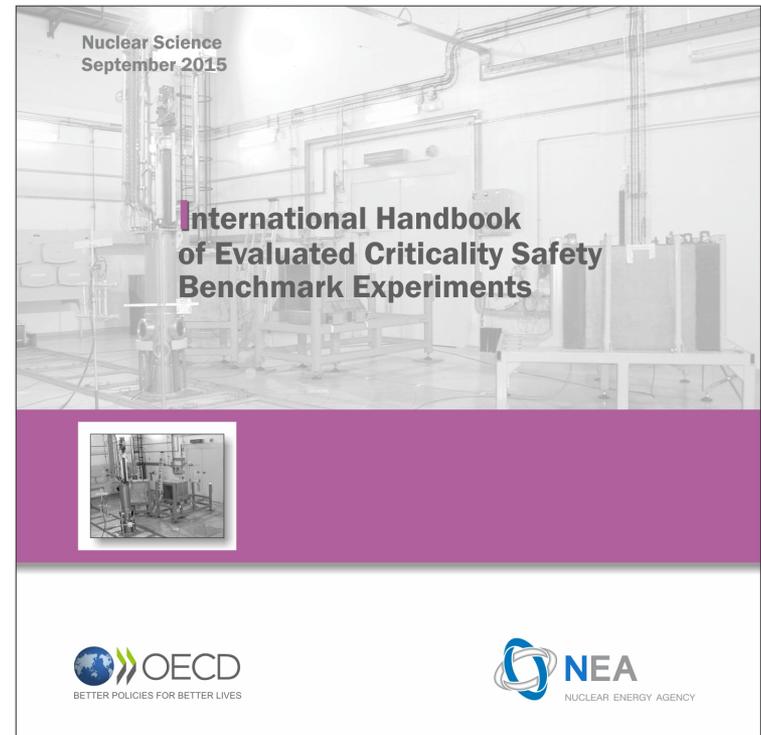




International Handbook of Evaluated Criticality Safety Benchmark Experiments

September 2015 Edition

- **20 Contributing Countries**
- **~69,000 Pages**
- **568 Evaluations**
 - 4,877 Critical, Near-Critical, or Subcritical Configurations
 - 31 Criticality Alarm Placement/ Shielding Configurations
 - 207 Configurations with Fundamental Physics Measurements
 - 829 Unacceptable Experiment Configurations



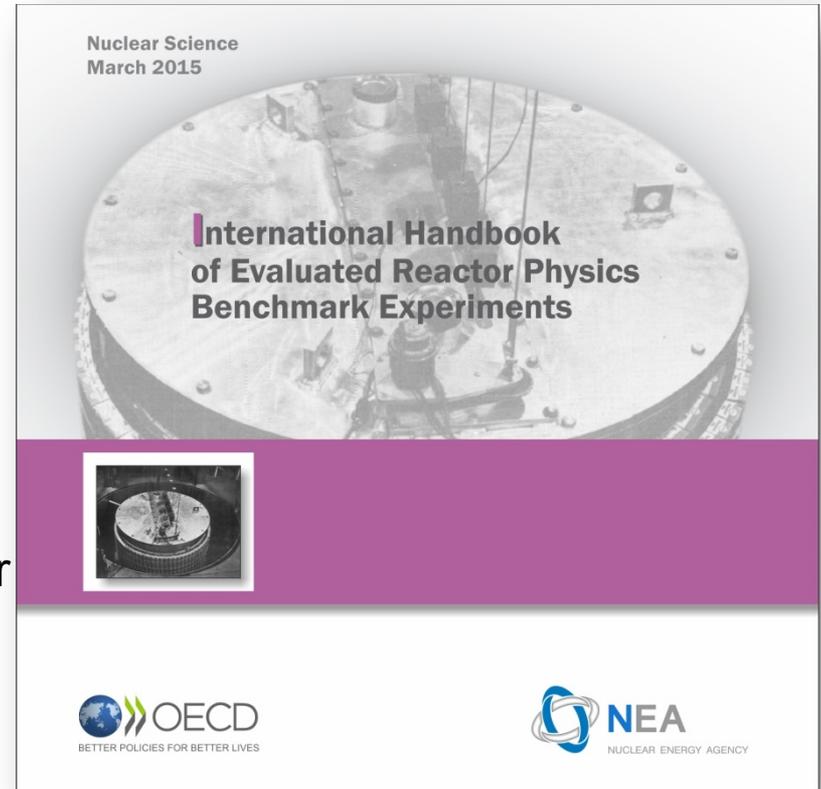
<http://www.oecd-nea.org/science/wpncs/icsbep/>



International Handbook of Evaluated Reactor Physics Benchmark Experiments

■ May 2015 Edition

- 20 Contributing Countries
- Data from 143 Experimental Series performed at 50 Reactor Facilities
- 139 evaluations are published as approved benchmarks
- Data from 4 series are published in DRAFT form
- Handbook available to OECD member countries, all contributing countries, and to others on a case-by-case basis



<http://www.oecd-nea.org/science/wprs/irphe/>

Accomplishments of ICSBEP & IRPhEP

The work of the ICSBEP and IRPhEP has:

- Highlighted gaps in data
- Retrieved lost data
- Helped to identify deficiencies and errors in cross section processing codes and neutronics codes
- Improved experimental planning, execution and reporting

Benchmark Evaluation Needs

- **Proposed benchmark evaluations should be of existing data.**

- **Measurements should include:**
 - Critical
 - Subcritical
 - Buckling
 - Spectral characteristics
 - Reactivity effects
 - Reactivity coefficients
 - Kinetics
 - Reaction-rate and power distributions
 - Miscellaneous neutron and gamma measurements



Example Benchmark Evaluation Needs

■ Small Modular Reactors

- i.e. NS Savannah

■ Boiling Water Reactors

- i.e. PSI Swiss LWR-PROTEUS Experiments

■ Molten Salt Reactors

- ORNL Molten Salt Reactor Experiment (MSRE)
- FLiBe Irradiation Experiments at Research Centre Rez (Czech Rep.)

■ Nuclear Data Testing

- Significant minor actinide content (burnup credit / fission products)
- Experiments sensitive to chlorine and/or fluorine
- GE-710 Tungsten Cermet Reactor
- Epithermal spectra and/or intermediate uranium enrichments

■ Research Reactors and associated measurements

Contact Information

- **Note: While many reactor measurements and critical experiments may not directly support current mainstream DOE programs, they do serve to fill gaps in nuclear data that may be necessary for future programs.**
- **Interested universities may contact INL international benchmark coordination and technical expert John.Bess@inl.gov**
or the Federal monitor Rob.Versluis@nuclear.energy.gov